## AMENDMENTS TO THE CLAIMS

Please amend Claims 1, 4, 16, 17, 19, 31, 32 and 37-40 as indicated below.

1. **(Currently Amended)** An optical apparatus comprised of:

an array of optical grating couplers fabricated on a first substrate comprising silicon; and

an array of optical devices on a second substrate, the first substrate being oriented in a first plane and the second substrate being oriented in a second plane, the first and second planes being substantially parallel;

wherein the first substrate is positioned substantially above the second substrate such that the array of optical grating couplers is optically aligned to the array of optical devices, light propagating out of the first plane from the array of optical grating couplers and into the second plane to the array of optical devices or out of the second plane from the array of optical devices and into the first plane to the array of optical grating couplers.

2. **(Previously Presented)** An optical apparatus of Claim 1, wherein the first and second substrates are secured with respect to each other by mechanical attachment.

3. **(Original)** An optical apparatus of Claim 1, wherein the array of optical devices is comprised of one or more arrayed elements from the list including: VCSELs, lasers, detectors, surface emitting lasers, light emitting diodes, super luminescent diodes, modulators, filters, fibers, fiber components, lenses, diffractive lenses, grating couplers, optical amplifiers, mirrors, and/or resonant cavities.

4. **(Currently Amended)** An optical apparatus of Claim 1, wherein the first substrate is formed from one or more of the following material systems: a silicon substrate~~,~~ and/or a silicon on insulator substrate~~, an indium phosphide substrate, a gallium arsenide substrate, and/or a germanium substrate~~.

5. **(Previously Presented)** An optical apparatus of Claim 2, wherein the securing mechanical attachment comprises a plurality of electrical connections.

6. **(Previously Presented)** An optical apparatus of Claim 5 wherein at least one of the plurality of electrical connection is comprised of C4 solder.

7. **(Previously Presented)** An optical apparatus of Claim 5 wherein at least one of the plurality of electrical connections is comprised of a gold bump.

8. **(Previously Presented)** An optical apparatus of Claim 5 wherein the plurality of electrical connections electrically couple a plurality of transistors formed on the first substrate and the array of optical devices.

9. **(Original)** An optical apparatus of Claim 8 wherein the plurality of transistors supply electrical signals to the array of optical devices.

10. **(Original)** An optical apparatus of Claim 8 wherein the plurality of transistors is used to sense and process electrical signals from the array of optical devices.

11. **(Original)** An optical apparatus of Claim 8 wherein the plurality of transistors is formed with a CMOS process.

12. **(Original)** An optical apparatus of Claim 1 wherein the mode field of the array of optical grating couplers is designed to match the mode field of the array of optical devices.

13. **(Original)** An optical apparatus of Claim 1 wherein the plurality of output signals of the array of optical grating couplers comprises a plurality of output signals of a wavelength demultiplexing device.

14. **(Original)** An optical apparatus of Claim 2 wherein the mechanical attachment is formed by a wafer bonding process.

15. **(Cancelled)**

16. **(Currently Amended)** An optical apparatus comprised of:

a plurality of optical grating couplers fabricated on a first substrate comprising silicon; and

a plurality of optical devices fabricated on a second substrate, the first substrate being oriented in a first plane and the second substrate being oriented in a second plane, the first and second planes being substantially parallel;

wherein the first substrate is positioned substantially above the second substrate such that the plurality of optical grating couplers and the plurality of optical devices are positioned between the first substrate and the second substrate with the plurality of optical grating couplers ~~is~~ optically aligned to the plurality of optical devices, light propagating out of the first plane from the array of optical grating couplers and into the

second plane to the array of optical devices or out of the second plane from the array of optical devices and into the first plane to the array of optical grating couplers.

17 **(Currently Amended)** An optical apparatus of Claim 16, wherein ~~the~~ the first and second substrates are secured with respect to each other by mechanical attachment.

18. **(Original)** An optical apparatus of Claim 16, wherein the plurality of optical devices is comprised of one or more arrayed elements from the list including: VCSELs, lasers, detectors, surface emitting lasers, light emitting diodes, super luminescent diodes, modulators, filters, lenses, diffractive lenses, grating couplers, optical amplifiers, mirrors, and/or resonant cavities.

19. **(Currently Amended)** An optical apparatus of Claim 16, wherein the first substrate is formed from one or more of the following material systems: a silicon substrate~~,~~ and/or a silicon on insulator substrate~~, an indium phosphide substrate, a gallium arsenide substrate, and/or a germanium substrate~~.

20. **(Previously Presented)** An optical apparatus of Claim 17, wherein the securing mechanical attachment is comprised of a plurality of electrical connections.

21. **(Previously Presented)** An optical apparatus of Claim 20 wherein at least one of the plurality of electrical connection is comprised of C4 solder.

22. **(Previously Presented)** An optical apparatus of Claim 20 wherein at least one of the plurality of electrical connections is comprised of a gold bump.

23. **(Previously Presented)** An optical apparatus of Claim 20 wherein the plurality of electrical connections electrically couple a plurality of transistors fabricated on the first substrate and the plurality of optical devices fabricated on the second substrate.

24. **(Previously Presented)** An optical apparatus of Claim 23 wherein the plurality of transistors supply electrical signals to the plurality of optical devices.

25. **(Previously Presented)** An optical apparatus of Claim 23 wherein the plurality of transistors is used to sense and process electrical signals from the plurality of optical devices.

26. **(Previously Presented)** An optical apparatus of Claim 23 wherein the plurality of transistors is formed with a CMOS process.

27. **(Original)** An optical apparatus of Claim 16 wherein the mode field of the plurality of optical grating couplers is designed to match the mode field of the plurality of optical devices.

28. **(Original)** An optical apparatus of Claim 16 wherein the plurality of output signals of the plurality of optical grating couplers comprises a plurality of output signals of a wavelength demultiplexing device.

29. **(Original)** An optical apparatus of Claim 17 wherein the mechanical attachment is formed by a wafer bonding process.

30. **(Previously Presented)** An optical apparatus of Claim 17 wherein the mechanical attachment is formed by fabricating the plurality of optical devices on top of the first substrate.

31. **(Currently Amended)** An optical apparatus comprised of:

an array of optical grating couplers formed on a first substrate; and

an array of optical devices formed on a second substrate, the first substrate being disposed above the second substrate so that the array of optical grating couplers ~~is~~ and the array of optical devices are positioned between the first and second substrates,

wherein the first substrate is a silicon on insulator substrate, the second substrate is an indium-phosphide based substrate and the substrates are mechanically fixed in optical alignment.

32. **(Currently Amended)** A method for optically coupling an array of optical devices formed on a first substrate to an array of optical grating couplers formed on a second substrate, comprising the steps of:

placing a plurality of alignment marks on the second substrate,

aligning ~~the~~ a first optical device of the array of optical devices on the first substrate to ~~the~~ a first optical grating coupler of the array of optical grating couplers on the second substrate,

aligning ~~the~~ a last optical device of the array of optical devices on the first substrate to ~~the~~ a last optical grating coupler of the array of optical grating couplers on the second substrate, and

attaching the array of optical devices to the array of optical grating couplers,

wherein the first and second substrates are stacked such that-the first substrate is above the second substrate with the array of optical grating couplers and the array of optical devices therebetween, wherein the second substrate is a silicon or a silicon on insulator substrate.

33. **(Original)** The method of claim 32, wherein each step of aligning further comprises the step of:

using a vision system with a pattern recognition for automated alignment.

34. **(Original)** The method of claim 32, wherein each step of aligning further comprises the step of:

using a plurality of mask alignment marks on a plurality of masks used to fabricate an array of optical devices for alignment.

35. **(Previously Presented)** The method of claim 32, wherein each step of aligning further comprises the step of:

sending a plurality of optical signals via a plurality of waveguides in the second substrate to the array of optical grating couplers,

detecting a plurality of optical output signals from the array of optical grating couplers, and

aligning the array of optical devices to increase the magnitude of the plurality of the optical output signals from the array of optical grating couplers.

36. **(Previously Presented)** The method of claim 32, wherein each step of aligning further comprises the step of:

sending a plurality of electrical signals to an array of light sources,

detecting a plurality of optical output signals from the array of light sources using an array of optical grating couplers on the second substrate, and

aligning the array of light sources to increase the magnitude of the plurality of the optical output signals from the array of light sources.

37. **(Currently Amended)** A flip-chip structure, comprising:

a plurality of planar waveguides on a first substrate providing a plurality of optical signals at a plurality of output ports,

an array of optical grating couplers on the second substrate comprising silicon, with a plurality of input ports coupled to the output ports of the plurality of waveguides on the first substrate, the plurality of optical grating couplers and the plurality of planar waveguides being positioned between the first substrate and the second substrate, and

an array of photodetectors on said second substrate, with each of the photodetectors coupled to a separate output port of one of the array of optical grating couplers, and each photodetector generating an electrical output signal in response to the detected optical signal.

38. **(Currently Amended)** A flip-chip structure, comprising:

a plurality of electrical signal lines on a first substrate, the plurality of electrical lines providing a plurality of electrical signals, the first substrate being oriented in a first plane,

an array of light sources on the first substrate, with each of the light sources coupled to a separate one of the plurality of electrical signal lines, and each light source generating an optical output signal in response to the received electrical signal, and

an array of optical grating couplers on a second substrate comprising silicon and oriented in a second plane, the first and second planes being substantially parallel, with a plurality of input ports coupled to the array of light sources on the first substrate, the optical output signal being propagated out of the first plane and to the array of optical grating couplers in the second plane.

39. **(Currently Amended)** An optoelectronic circuit integrated on a substrate for electrical signal distribution, comprising:

a light source for generating an optical signal at an output port in response to a received electrical signal,

an optical grating coupler with an input port coupled to the output port of the light source, and with an output port,

a light splitting planar waveguide device, comprised of a waveguide and a light splitter, with an input port coupled to the output port of the optical grating coupler, and with a plurality of output ports,

an array of optical grating couplers on a silicon substrate, with each input port coupled to a separate one of the plurality of output ports of the light splitting planar waveguide device, and with a plurality of output ports, the array of optical grating couplers disposed in a first plane, optical signals propagating out of the first plane from the array of optical grating couplers, and

an array of photodetectors, with each photodetector optically coupled to a separate one of the outputs of the array of optical grating couplers, the array of photodetectors disposed in a second plane, the optical signals propagating into the second plane to the array of photodetectors, and each photodetector generating an electrical signal in response to the detected optical signal.

40. **(Currently Amended)** The method of claim 32, wherein said first ~~and second~~ substrates comprises a semiconductor substrates.